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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/606,066	06/24/2003	Zhiwei (Steve) Xu	5589-05900 P1150	1627

7590 10/07/2004

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EXAMINER	
NATALINI, JEFF WILLIAM	

ART UNIT	PAPER NUMBER
2858	

DATE MAILED: 10/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/606,066	XU ET AL.	
	Examiner	Art Unit	
	Jeff Natalini	2858	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 September 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 June 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/6/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Election/Restrictions

1. Applicant's election without traverse of invention I (claims 1-16) in the reply filed on September 14, 2004 is acknowledged.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-4, 6-9, 11-13, 15, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Measurement of work function change with surface segregation of substrate element on a deposited film", by Yoshitake et al. (hereby to be referred to as Yoshitake et al.) in view of Verkuil et al. (6202029).

In regard to claims 1 and 2, Yoshitake et al. discloses a method for calibrating a work function (end paragraph on pg 97 continued on to pg 98), which prepares a reference sample to have a substantially stable work function (last sentence of abstract continued to the first paragraph of the introduction on pg 97).

Yoshitake et al. lacks wherein the calibration is done for a non-contact voltage sensor by measuring a voltage of the reference sample using a non-contact voltage sensor; and determining a work function correction factor of the non-contact voltage sensor from the measured voltage by determining a

difference between the measured reference voltage and a previously measured voltage of the reference sample.

Verkuil et al. discloses wherein the calibration is done for a non-contact voltage sensor by measuring a voltage of the reference sample using the non-contact voltage sensor (col 2 line 7-14, the sensor is non-contact as it is a Kelvin probe (col 2 line 43) known in the art to be non-contact); and determining a work function correction factor of the non-contact voltage sensor (col 3 line 54-55; V.sub.wf corresponds to the work function difference between the sensor (Kelvin probe) and the sample, thus it is the correction value for the sensor to work correctly) from the measured voltage by determining a difference between the measured reference voltage and a previously measured voltage of the reference sample (col 7 line 6-10).

It would have been obvious to one with ordinary skill in the art at the time the invention was made for Yoshitake et al. to perform calibration on a non-contact voltage sensor by measuring a voltage of the reference sample using a non-contact voltage sensor; and determining a work function correction factor of the non-contact voltage sensor by determining a difference between the measured reference voltage and a previously measured voltage of the reference sample as taught by Verkuil et al. in order to properly measure voltage across the sample to determine the tunneling field (col 2 line 23-25).

In regard to claim 3, Yoshitake et al. lacks wherein the step of determining the work function correction factor comprises calculating the work function of the

non-contact voltage sensor from a known work function of the reference sample and preset voltage values of the reference sample and the non-contact voltage sensor.

Verkuil et al. disloses wherein the step of determining the work function correction factor comprises calculating the work function of the non-contact voltage sensor from a known work function of the reference sample and preset voltage values of the reference sample and the non-contact voltage sensor (col 3 line 59-65).

It would have been obvious to one with ordinary skill in the art at the time the invention was made for Yoshitake et al. to incorporate determining the work function correction factor by using a known work function of the reference sample and preset voltage values of the reference sample and the non-contact voltage sensor as taught by Verkuil et al. in order to estimate the actual value of the oxide voltage (col 3 line 59).

In regard to claim 4, Yoshitake et al. discloses wherein preparing the reference sample comprises controlling an environment around the reference sample (pg 98, 1st paragraph under subheading 3.2).

In regard to claim 6, Yoshitake et al. discloses wherein the step of controlling the environment of the sample comprises exposing an isolated chamber storing the sample to one environmental parameter (pg 98, 1st paragraph under subheading 3.2- "specimen was heated at 700K in a ultrahigh vacuum"), and wherein the step of measuring comprises terminating the

exposure of the parameter to the isolated chamber (pg 98, 1st paragraph under subheading 3.2. "the specimen is kept at 550K to measure the work function".

Yoshitake et al. lacks wherein the voltage of the sample is measured.

Verkuil et al. teaches that the voltage is measured in determining the work function (col 3 line 59-65).

It would have been obvious to one with ordinary skill in the art at the time the invention was made for Yoshitake et al. to measure the voltage of the sample as taught by Verkuil et al. in order to properly determine the work function.

In regard to claim 7, Yoshitake et al. discloses controlling the environment around the sample by storing the sample in an isolated area (pg 98, 1st paragraph under subheading 3.2- "specimen was heated at 700K in a ultrahigh vacuum").

In regard to claim 8 and 9, Yoshitake et al. discloses controlling the environment by purging the area around the reference sample with an inert gas (pg 98, 1st paragraph under subheading 3.2- "the surface (of the substrate) was cleaned by Ar ion bombardment"); it would be inferred that the purging would occur at time intervals between .001 seconds and 1 hour thus being at a frequency of .0001 Hz and 1KHz in order to keep the surface clean.

In regard to claim 11, Yoshitake et al. discloses controlling the environment by inducing a vacuum about the reference sample (pg 98, 1st paragraph under subheading 3.2- "specimen was heated at 700K in a ultrahigh vacuum").

In regard to claim 12, Yoshitake et al. discloses wherein the step of controlling the environment around the sample is maintained at a temperature between 20 degrees and 1000 degree's Celsius for a time of between 1 second and 1 hour (pg 99, 1st paragraph in column 2, it is disclosed after measuring the work function on the surface-described in the first paragraph under section 3.2 (pg 98) to be at 550K (approx = 477 degrees Celsius)- and it would be inferred it takes between a few seconds and a few minutes for the measurement to take place before the environment is cooled to room temperature).

In regard to claim 13, Yoshitake et al. discloses wherein the step of preparing the sample comprises stripping a surface of the sample (pg 97, introduction 2nd paragraph- "surface concentration is recovered by heating after the removal of the saturated surface layer").

In regard to claim 15, Yoshitake et al. lacks wherein the reference sample comprises doped microelectronic materials.

Verkuil et al. discloses the reference being a silicon substrate (col 3 line 15-22).

It would have been obvious to one with ordinary skill in the art at the time the invention was made for Yoshitake et al. to incorporate the silicon substrate as the sample as taught by Verkuil et al. in order to provide a measurement of the I-V behavior (col 3 line 10-11).

In regard to claim 16, Yoshitake et al. discloses wherein the sample comprises noble metals (pg 98, Experimental section, platinum and copper are known in the art to be noble metals as they are resistant to oxidation).

4. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshitake et al. in view of Verkuil et al. (6202029) as applied to claim 4 above, and further in view of On (6138054).

Yoshitake et al. and Verkuil et al. lack wherein the reference sample is removed from the controlled environment prior to measuring the reference sample voltage; and returned to the controlled environment subsequent to the measuring of the reference sample voltage.

On discloses wherein the reference sample is removed from the controlled environment prior to measuring the reference sample voltage (col 4 line 33-36); and returned to the controlled environment subsequent to the measuring of the reference sample voltage (col 5 line 23-29).

It would have been obvious to one with ordinary skill in the art at the time the invention was made for Yoshitake et al. and Verkuil et al. to remove the reference sample prior to measurement and return the reference sample after measurement as taught by On in order to avoid a hazard to personnel while measuring the voltage (col 1 line 24-26).

5. Claims 10 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshitake et al. in view of Verkuil et al. (6202029) as applied to claim 4 above, and further in view of Ma et al. (6011404).

In regard to claim 10, Yoshitake et al. and Verkuil et al. lack wherein the step of controlling the environment comprises illuminating the reference sample.

Ma et al. discloses illuminating the reference sample (col 10 line 37-42).

It would have been obvious to one with ordinary skill in the art at the time the invention was made for Yoshitake et al. and Verkuil et al. to illuminate the reference sample as taught by Ma et al. in order to create excess carriers (col 10 line 40).

In regard to claim 14, Yoshitake et al. and Verkuil et al. lack wherein the step of preparing the reference sample comprises forming a layer upon a surface of the reference sample.

Ma et al. discloses depositing corona charges on the top surface of the sample to create an inverted surface with a depletion region (col 4 line 39-42).

It would have been obvious to one with ordinary skill in the art at the time the invention was made for Yoshitake et al. and Verkuil et al. to form a layer upon the surface of the sample as taught by Ma et al. in order to have a field induced junction in the sample semiconductor wafer (col 4 line 42).

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Verkuil et al. (6060709) teaches stabilizing the work function of the wafer compared to the sensor by introducing a uniform charge density on the wafer.

Lowell et al. (5963783) teaches detecting a charge in a semiconductor substrate using a non-contact measurement and illuminates the sample.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeff Natalini whose telephone number is 571-272-2266. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, N. Le can be reached on 571-272-2233. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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